

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAMES

Pseudanophthalmus colemanensis Barr
Pseudanophthalmus fowlerae Barr
Pseudanophthalmus inquisitor Barr
Pseudanophthalmus insularis Barr
Pseudanophthalmus tiresias Barr
Pseudanophthalmus paulus Barr

COMMON NAMES

Coleman Cave beetle
Fowler's Cave beetle
Inquirer Cave beetle
Insular (=Baker Station) Cave beetle
Soothsayer Cave (=Indian Grave Point) beetle
Noblett's Cave beetle

LEAD REGION: 4

INFORMATION CURRENT AS OF: March 2010

STATUS/ACTION:

Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☒ Non-petitioned

☐ Petitioned - Date petition received: Inquirer cave beetle, May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date:

Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ Listing priority change

Former LP: ____

New LP: ____

Date when the species first became a Candidate (as currently defined): May 4, 2004

___ Candidate removal: Former LP: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insects – Carabidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Pseudanophthalmus colemanensis, Coleman Cave beetle, Montgomery County, TN

Pseudanophthalmus fowlerae, Fowler's Cave beetle, Clay County, TN

Pseudanophthalmus inquisitor, Inquirer Cave beetle, Clay County, TN

Pseudanophthalmus insularis, Insular (=Baker Station) Cave beetle, Davidson County, TN

Pseudanophthalmus tiresias, Soothsayer Cave (=Indian Grave Point) beetle, DeKalb County, TN

Pseudanophthalmus paulus, Noblett's Cave beetle, Monroe County, TN

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Pseudanophthalmus colemanensis, Coleman Cave beetle, Montgomery County, TN

Pseudanophthalmus fowlerae, Fowler's Cave beetle, Clay County, TN

Pseudanophthalmus inquisitor, Inquirer Cave beetle, Clay County, TN

Pseudanophthalmus insularis, Insular (=Baker Station) Cave beetle, Davidson County, TN

Pseudanophthalmus tiresias, Soothsayer Cave (=Indian Grave Point) beetle, DeKalb County, TN

Pseudanophthalmus paulus, Noblett's Cave beetle, Monroe County, TN

LAND OWNERSHIP: All of the caves supporting these species are privately owned.

LEAD REGION CONTACT: Southeast Region Office, Rob Tawes, 404-679-7142,
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LEAD FIELD OFFICE CONTACT: Cookeville, Tennessee Field Office, Geoff Call, 931-528-6481,
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BIOLOGICAL INFORMATION:

The insect genus *Pseudanophthalmus* is in the predatory ground beetle family Carabidae. Most members of this genus are cave dependent (troglobites) and are not found outside the cave environment. Barr (1996, page 3) states that there are approximately 255 species in the genus *Pseudanophthalmus*. All are predatory and feed upon small cave invertebrates such as spiders, mites, millipedes, and

diplurans, while the larger *Pseudanophthalmus* species also feed on cave cricket eggs (Barr 1996, page 6). Members of this genus vary in rarity from fairly common, widespread species that are found in many caves to species that are extremely rare and restricted to only one cave or, at most, two caves.

Cave beetles in the genus *Pseudanophthalmus* are fairly small, eyeless, reddish-brown insects. Like most other insects, they have six legs and a body that consists of a head, thorax, and abdomen. Body length is generally from 3.0 to 8.0 millimeters (mm) (0.12 to 0.32 inches), depending upon the species. The different species within the genus are differentiated by differences in the shape and size of the various body parts, especially the shape of the male appendages used during reproduction.

Minimum detailed life history information is available for the rarest of the cave beetles that are considered here, but the generalized summary that follows is accurate for the more common and more easily studied species and is believed to also apply to the rarer species (Barr 1998, page 3). Cave beetles copulate in the fall, and the eggs are deposited in the cave soil during late fall. The eggs hatch and larvae appear in late fall through early winter. Pupation occurs in late winter to early summer with the adult beetles emerging in early summer (Barr 1996, page 5).

The limestone caves in which these cave beetles are found provide a unique and fragile environment that supports a variety of species that have evolved to survive and reproduce under the demanding conditions found in cave ecosystems. No photosynthesis takes place within the dark zone of a cave. Therefore, all organisms that are adapted to life within a cave are dependent upon energy from the surface. This energy can be in the form of leaf litter, woody debris or small bits of organic matter that is washed or falls into the cave, or guano deposited by cave-dependent bats that feed on the surface and return to the cave to roost (Barr 1996, pages 6, 7).

Pseudanophthalmus colemanensis, the Coleman Cave beetle, was described by Barr (1959, pages 5-30) based upon a few specimens he collected in 1957 from Coleman Cave, Montgomery County, Tennessee. Until 2004, this was the only known site for the species. During a 1999 visit to the cave one specimen was observed by Barr and others (Barr 2001, page 5). A new location for the species was discovered in 2004 by David Withers, Tennessee Department of Conservation, during a biological inventory of Foster Cave. One specimen of the species was found during that survey. Foster Cave (also called Darnell Cave and Cooper Creek Cave) is on a preserve owned and managed by the Tennessee Department of Conservation. In 2006, H. Garland, The Nature Conservancy, discovered a specimen of this species in Bellamy Cave and J. Lewis, conducting cave invertebrate surveys in Tennessee in cooperation with The Nature Conservancy, discovered it in Darnell Spring Cave. The species is now represented by a few specimens each from Bellamy and Foster caves (Barr pers. comm. 2010). All of these sites are in close proximity to each other. Bellamy Cave is owned and managed by the Tennessee Wildlife Resources Agency (TWRA). Both Foster Cave and Bellamy Cave were first acquired and protected by The Nature Conservancy and later transferred to the state for long-term protection and management.

Pseudanophthalmus fowlerae, Fowler's cave beetle, was described by Barr (1980; pages 88, 89) from 11 specimens collected from 1959 through 1965 from Sheals Cave, Clay County, Tennessee. The species is not known from any other caves. Fowler's cave beetle has not been observed or collected since 1965. Barr (2001; pages 7, 8) believes that it probably still exists in low numbers. In 2005, the landowner, The Nature Conservancy, TWRA, and the Service entered into a Cooperative Management Agreement for the cave.

Pseudanophthalmus inquisitor, the Inquirer Cave beetle, was described by Barr (1980, pages 94, 95) from specimens collected in Sheals Cave, Clay County, Tennessee. The species is not known from any other caves. During a 1997 survey, Barr (1998; pages 5, 6) observed 3 specimens of inquirer cave beetle. In October 2006 the species was observed in Sheals Cave by Dr. J. Lewis while conducting cave invertebrate surveys for The Nature Conservancy (Lewis and Lewis 2007; pages 15, 24, 25).

Pseudanophthalmus insularis, the Insular (=Baker Station) cave beetle, was described by Barr (1980, page 93) from 8 specimens collected in 1956 and 1957 from Baker Station Cave, Davidson County, Tennessee. Barr (2001; pages 12, 13) reported that the cave was searched in 1998 for this species and no additional specimens were found. Although the species has not been observed since 1957, Barr (2001; pages 3, 12, 13) believes that it probably still exists in low numbers. Barr (2009, pers. comm.) reported that an examination of early unmounted beetle collections from Bull Run Cave, Davidson County, Tennessee, revealed that the species also occurs there. No information on the species status in Bull Run Cave is currently available.

Pseudanophthalmus tireias, the Soothsayer Cave (=Indian Grave Point) beetle, was described in 1959. At the time of the original description, this species was considered one of seven subspecies within a variable species complex. After further study of the group Barr (1980, page 92) elevated all seven of these subspecies to full species. This is the currently accepted taxonomic treatment of this group. The original description of this taxon was based upon six specimens collected from Indian Grave Point Cave, DeKalb County, Tennessee, in 1956. These specimens were collected near the cave's entrance sink in an area that had high humidity, stable temperatures and a few fragments of rotten wood that had fallen into the sink (Barr 2001; pages 14, 15.) Four specimens were later collected from nearby Fox Cave (Barr 1993). Three searches were conducted between 1997 and 1999, but no additional specimens of this species have been found. Despite the recent failures to find the species, Barr (2001; pages 14, 15) believes that the Soothsayer Cave (=Indian Grave Point) beetle is still present in Indian Grave Point and Fox caves, in at least very low numbers.

Pseudanophthalmus paulus, Noblett's Cave beetle, was described by Barr (1981, page 63) from two specimens collected in 1967, from Noblett's Cave, Monroe County, Tennessee. Despite several searches conducted in this cave by Wallace (Barr 2001, page 24; Wallace 1989, page 5) and in other caves in the vicinity by Barr (2001), no additional specimens have been found. Barr (2001, page 24) believes that it probably still exists in low numbers. Noblett's Cave is a small (about 500 feet long) muddy cave with a stream flowing through it.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Four of these six cave beetles (Fowler's Cave beetle, Inquirer cave beetle, Insular (=Baker Station) cave beetle and Noblett's Cave beetle) are currently known from only one cave. The Soothsayer Cave beetle occurs in two caves and the Coleman Cave beetle is known from four caves.

Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction (Barr 1996, page 9, 10).

Caves and the species that are completely dependent upon them (troglobites) receive the energy that forms the basis of the cave food chain from outside the cave. This energy can be in the form of bat guano deposited by cave-dependent bats, large or small woody debris washed or blown into the cave, or tiny bits of organic matter that is carried into the cave by water through small cracks in the rocks overlaying the cave (Barr 1996; page 6, 7).

Activities such as industrial, residential, commercial, or highway construction can, if not planned in a

manner to protect caves, directly destroy caves or result in severe modification of the natural processes that maintain the sensitive biological systems they support. Examples of these types of threats can be seen with two current candidates (*P. caecus*, the Clifton Cave beetle; and *P. troglodytes*, the Louisville cave beetle), which have both had one of their two known caves destroyed due to construction-related activities. Pollution and chemical contamination can, under certain circumstances, result in the complete destruction of the unique life found within a cave impacted by these factors. Vandalism and trash dumping have affected some of the sites and all but Foster's Cave and Coleman's Cave are vulnerable to these activities. Loss or reduction of the supply of energy, such as may be occurring to the Coleman Cave beetle due to the alteration of an upper sinkhole cave entrance by past dumping and debris disposal can result in the loss or severe reduction of cave beetle populations (Barr 1996, pages 16, 17).

Guano deposited in caves by cave dependent bats, such as the endangered gray bat, often forms the basis of the food chain within a cave. As noted above, higher trophic level species, like the Coleman Cave beetle and other predatory cave species, are indirectly dependent upon outside sources of organic matter such as bat guano. In 1957, Coleman Cave supported an endangered gray bat maternity colony. Either because of human disturbance of the colony during the maternity season or because of changes in cave microclimate caused by the closure of an upper level entrance to the cave, Coleman Cave no longer supports a maternity colony. The Nature Conservancy has developed a Cooperative Management Agreement with the owner of this cave and has taken active steps to protect the site from human disturbance. This action should reduce human disturbance at the cave and should benefit the gray bat. However, the blocked upper entrance to the cave may have changed cave temperatures and moisture levels in a manner that makes the site unsuitable for gray bat use. It may be necessary to restore this upper entrance so that Coleman Cave will once again support a gray bat maternity colony. Until a dependable source of organic matter is provided to the Coleman Cave beetle population, either by reestablishment of the gray bat colony or from some other sources this species is vulnerable to extinction.

Sheals Cave is located in a rapidly expanding urban area and indirect impacts, such as chemical or other pollution, could significantly impact both the cave and the species the cave supports. A sinkhole that drains into the cave system is located away from the protected entrance and is near a highway. Chemical and other spills could easily enter the cave system through this sinkhole entrance. Alterations in the landscape associated with an expanding urban area are expected and could negatively affect the cave system that contains the inquirer cave beetle (Barr 1998, page 6; 2001, page 8). Baker Station Cave was once used as a domestic water supply, but a nearby landfill and pollution from other sources has contaminated the water to the point that it is no longer potable. During the 1998 visit, severe pollution of springs and creeks in the vicinity of the cave was observed. Noblett's Cave may suffer due to its proximity to an interstate highway interchange.

Dependence upon the surface makes caves and the biota that is found within them vulnerable to actions that take place well outside and away from the cave. Protection of caves and cave dependent species must include both the physical environment in which the species are found and the surface components that provide the energy and clean water needed for survival.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Each of these cave beetle species is known to occur at no more than four locations. Most populations are extremely small and careless collecting, whether for scientific or other purposes, could adversely affect them. These species have no known commercial value, however, the caves in which these

species occur may be used for recreational purposes by spelunkers and by other recreationists.

C. Disease or predation.

Disease or predation is not known to be a significant problem for any of these species. However, since each species appears to exist with low numbers of individuals, mortality via either of these two factors may have a significant, negative impact on recruitment and long-term survival.

D. The inadequacy of existing regulatory mechanisms.

None of these species receives any official State or Federal protection. Coleman Cave is under a cooperative management agreement with the landowner and Foster Cave is owned by the Tennessee Department of Environment and Conservation. These species are not protected under Tennessee state law.

E. Other natural or manmade factors affecting its continued existence.

As noted above, guano often forms the basis of the food chain in cave ecosystems. With the spread of white-nose syndrome into bat populations in Tennessee, documented during 2010, it is likely that populations of cave-hibernating bats will experience drastic declines in coming years. If such declines are observed, this could disrupt the trophic system in affected caves and cause cascading effects on populations of invertebrates that are dependent on bats for transferring sources of energy from the outside world to the subterranean environment. We cannot predict the rate of spread of white-nose syndrome in Tennessee and the potential effects upon bat populations where these cave beetles occur, thus we do not consider this threat imminent at this time.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

In 1989 the Service developed a Volunteer Service Agreement with Richard Wallace, Knoxville, Tennessee, to conduct surveys for six rare cave beetles found in Eastern Tennessee and adjacent portions of Southwestern Virginia. Noblett's Cave beetle was one of the beetles examined by Mr. Wallace (Wallace 1989, page 5). Based upon the information provided in this report, the Service sent formal notification (July 1990) of a status review of five of these species to 51 individuals or organizations. Two letters were received in response to our notice. One was from the Tennessee Valley Authority's Natural Heritage Program stating that they had no new information on these species and the other was from Dr. Thomas Barr stating that there were at least 50 beetles within the genus *Pseudanophthalmus* that needed to be included in the status review. In response to this information the Service, in cooperation with Kentucky Department of Fish and Wildlife Resources (KDFWR), funded a survey of 21 cave beetles. After completion of the surveys in Kentucky, the Service, in cooperation with TWRA, funded a status survey for 27 rare cave beetles that occur in Tennessee or adjacent portions of Alabama or Georgia. Dr. Barr provided a final report on the Kentucky species in 1996 and a final report for the Tennessee project in 2001. In 1999, nine of the beetles included in the Kentucky report were elevated to candidate status.

While gathering the land ownership information needed for the final reports on these cooperatively funded projects (Barr 1996, pages 11-55; 1998, pages 4-10 and 2001, pages 5-32), the landowners, when they could be contacted, were made aware of the presence of the rare cave beetles within caves on their land. Most owners were pleased to learn of the presence of a rare species within their caves and are expected to be willing to assist with any protection activities needed to protect and recover these cave beetles. The KDFWR and TWRA both actively participated in gathering the information presented in Barr (1996, page 60, 1998; page 1, and 2001, page 1) on the status of these species. It is anticipated that they will continue to support and participate in rare cave beetle protection. In 2001, the owners of Coleman Cave, The Nature Conservancy, TWRA, the Service and others entered into a Cooperative

Management Agreement for the cave. Foster Cave was purchased by The Nature Conservancy and is currently owned by the Tennessee Department of Conservation. Bellamy Cave was also purchased by The Nature Conservancy; ownership has now been transferred to the TWRA for long-term management and protection. Sheals Cave is currently protected by the landowners from any physical alterations that could adversely affect the species; and in 2005, the landowners entered into a Cooperative Management Agreement for the cave with The Nature Conservancy, TWRA, and the Service.

SUMMARY OF THREATS

All of these cave beetles are currently known from only one to four caves, depending on the species. Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction. With the discovery of white-nose syndrome in bat populations in Tennessee, it is likely that populations of cave-hibernating bats will suffer drastic declines, disrupting food chains dependent upon guano deposition as a source of energy input from the outside world. We find that these species are warranted for listing throughout their entire geographic ranges, and, therefore, find that it is unnecessary to analyze whether they are threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES:

Maintain/establish landowner contact. Establish/maintain conservation agreements or memoranda of understanding to ensure appropriate management of caves supporting these species. Construct gates or other appropriate barriers to control human access when necessary. Monitor population levels annually and search for additional populations. Monitor existing threats to these species and to the caves that support them. Develop and implement plans to reduce or eliminate direct and indirect threats to these species. Continue annual review of the status of these species.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
	Non-imminent	Species	2
		Subspecies/population	3
		Monotypic genus	4
		Species	5*
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
	Non-imminent	Species	8
		Subspecies/population	9
		Monotypic genus	10
		Species	11**
		Subspecies/population	12

* **Fowler's Cave beetle, Insular (=Baker's Station) Cave beetle, Soothsayer Cave (=Indian Grave Point) beetle and Noblett's cave beetle**

** **Coleman Cave beetle**

Rationale for listing priority number:

Magnitude: All of these cave beetles are currently known from only one to four caves. Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction. No formal protection is currently provided to three of these five cave beetles and the magnitude of the threats they face is high. Although Fowler's cave beetle has not been seen since 1965, the cave supporting it (Sheals Cave) is protected from entrance alterations through a Cooperative Management Agreement. The fifth species (Coleman Cave beetle) currently receives some protection under a formal Cooperative Management Agreement for Coleman Cave and state ownership of Foster Cave and Bellamy Cave, consequently, the threats it faces are more moderate.

Imminence: The threats faced by these species are significant, however, it is not anticipated that they will be subject to these threats in the immediate future (next 1-2 years).

YES Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Given the current status and the magnitude and imminence of the threats to these species, emergency listing is not warranted at this time.

DESCRIPTION OF MONITORING

The Nature Conservancy regularly monitors the sites for which they have obtained Cooperative Management Agreements and the site that they currently own. This monitoring of Foster Cave, which is part of a preserve established for other species, revealed the presence of a previously unknown population of the Coleman's Cave beetle. The Nature Conservancy has developed the Tennessee Cave Initiative with TWRA and others to identify and protect sites that support federally listed, candidate and special concern cave dependent species. As a part of this initiative they regularly monitor the sites that support these cave beetles and work to gain long term protection for them. In this monitoring effort The Nature Conservancy is working cooperatively with Dr. Jerry Lewis, who is conducting systematic surveys of Tennessee's cave invertebrates (Lewis and Lewis 2007, pages 1-42).

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: Tennessee


These species are included in Tennessee's Wild Action Plan as Tier 2 species (Tennessee Wildlife Resources Agency 2005). Tier 2 species are of concern but no State agency has management responsibility for them.

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED:

- Barr, Thomas C. 1959. New cave beetles (Carabidae, Trechini) from Tennessee and Kentucky. *Journal Tennessee Academy of Science* 34:5-30.
- Barr, Thomas C. 1980. New species groups of *Pseudanophthalmus* from the Central Basin of Tennessee (Coleoptera: Carabidae: Trechini). *Brimleyana* (3): 85-96.
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- Barr, Thomas C. 1993. Letter to Robert Currie, US Fish and Wildlife Service, Asheville, NC March 22, 1993.
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- Barr, Thomas C. 1998. Study of Potentially Threatened or Endangered Species of Cave Beetles in Tennessee, Alabama and Georgia. Interim Progress Report to the Tennessee Wildlife Resources Commission. 11 pp.
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- Barr, Thomas C. 2009. Personal Communication to Robert Currie, US Fish and Wildlife Service, Asheville, NC January 23, 2009.
- Barr, Thomas C. 2010. Email to Geoff Call, US Fish and Wildlife Service, Cookeville, Tennessee. March 3, 2010.
- Lewis, Julian J. and Salisa L. Lewis. 2007. A Biological Reconnaissance of Selected Caves in the Highland Rim Area of Central Tennessee. Lewis & Associates, LLC, Cave, Karst & Groundwater Biological Consulting, Borden, IN. Final Report to The Nature Conservancy, Nashville, TN. 42 pp.
- Tennessee Wildlife Resource Agency. 2005. Tennessee's Comprehensive Wildlife Conservation Strategy. TWRA. Nashville, Tennessee.
- Wallace, Richard L. 1989. Report on a Carabid Beetle Survey. Unpublished report to the U.S. Fish and Wildlife Service, Asheville, NC. 6 pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  _____ June 14, 2010
_____ for Regional Director, Fish and Wildlife Service Date

Concur: _____ Director, Fish and Wildlife Service _____ Date

Do not concur: _____ Director, Fish and Wildlife Service _____ Date

Director's Remarks

Date of annual review: March 30, 2010

Conducted by: Geoff Call, Fish and Wildlife Biologist, Cookeville, Tennessee Field Office